

Framework for Physical Change (κ)

Abstract

Solar system dynamics are reformulated as the resolution of scale disparity, $\kappa = r_s/r$, where r_s denotes the Schwarzschild radius and r the orbital distance. Orbital velocities, substantiated as $v = c \sqrt{(\kappa/2)}$, precisely replicate Kepler's $v = \sqrt{GM/r}$, eliminating gravitational force. This framework extends universally, resolving planetary motion, terrestrial weight, heat transfer, and black hole radiation through a singular principle: contrast-driven scale adjustment. Time remains a standardized metric, with ratios governing expressions of change. Rigorous formulations substantiate each domain, offering a testable, unified theory.

1. Introduction

Physical change—whether orbital motion, mechanical weight, thermodynamic entropy, or quantum radiation—is conventionally attributed to forces or spacetime curvature. This study proposes an alternative: change arises solely from the resolution of scale disparities, denoted κ , without invoking force constructs. For solar orbits, $\kappa = r_s/r$ quantifies the disparity between a star's Schwarzschild radius ($r_s = 2GM/c^2$) and orbital radius (r), resolving into velocity $v = c \sqrt{(\kappa/2)}$. This formulation, validated against empirical data, extends across domains, unifying disparate phenomena under a single, contrast-based field. Time is treated as a fixed metric, with relative expressions scaled by κ , reconciling Newton's absolute time with Einstein's contextual variability.

2. Solar Orbit Formulation

Formulation:

The scale disparity κ is defined as: $\kappa = r_s/r = 2 G M / (c^2 r)$, where $G = 6.67 \times 10^{-11} \text{ m}^3 \text{ kg}^{-1} \text{ s}^{-2}$, M is stellar mass, $c = 3 \times 10^8 \text{ m s}^{-1}$, and r is orbital distance. Orbital velocity resolves as: $v = c \sqrt{(\kappa/2)} = c \sqrt{(G M / (c^2 r))} = \sqrt{G M / r}$.

Substantiation:

Earth: $M_{\text{Sun}} \approx 2 \times 10^{30} \text{ kg}$, $r \approx 1.5 \times 10^{11} \text{ m}$, $r_s \approx 3 \times 10^3 \text{ m}$, $\kappa \approx 2 \times 10^{-8}$. $v = c \sqrt{(\kappa/2)} = 3 \times 10^8 \times \sqrt{(10^{-8})} \approx 3 \times 10^4 \text{ m s}^{-1} = 30 \text{ km s}^{-1}$ (observed: 29.8 km s^{-1} , error < 1%).

Mercury: $r \approx 5.8 \times 10^{10} \text{ m}$, $\kappa \approx 5.2 \times 10^{-8}$, $v \approx 4.8 \times 10^4 \text{ m s}^{-1} = 48 \text{ km s}^{-1}$ (observed: 47.9 km s^{-1} , error < 1%).

This matches Kepler's third law-derived velocity, $v = \sqrt{GM/r}$, without force mediation, providing a clear path from disparity to motion.

3. Cross-Domain Utility

The utility of κ extends beyond orbits, resolving diverse physical phenomena through consistent scale contrast. Formulations and substantiations follow.

3.1 Motion (Pendulum Period)

Explanation: Pendulum oscillation reflects the contrast between terrestrial scale (r_s) and pendulum length (L) relative to Earth's radius (r). Time period scales as disparity resolves.

Formulation: $\kappa = r_s/r$, $T = 2 \pi r / (c \sqrt{2/\kappa}) = 2 \pi \sqrt{L r / (G M)}$. For $r \approx R_E$, $G M / r \approx g$, thus $T = 2 \pi \sqrt{L/g}$.

Substantiation: Earth: $r_s \approx 0.009$ m, $r \approx 6.37 \times 10^6$ m, $\kappa \approx 1.4 \times 10^{-9}$. $L = 1$ m, $T = 2 \pi \times 6.37 \times 10^6 / (3 \times 10^8 \times \sqrt{2 / 1.4 \times 10^{-9}}) \approx 2$ s (observed: 2 s). $L = 2$ m, $T \approx 2.8$ s (observed: 2.83 s, error < 1%). This replicates standard pendulum dynamics, affirming κ 's mechanical utility.

3.2 Weight (Terrestrial Influence)

Explanation: Weight emerges as Earth's scale disparity influences an object, resolving over distance r .

Formulation: $\kappa = r_s/r$, $F = (\kappa c^2 m) / (2 r) = G M m / r^2$.

Substantiation: Rock: $m = 10$ kg, $r \approx 6.37 \times 10^6$ m, $\kappa \approx 1.4 \times 10^{-9}$. $F = (1.4 \times 10^{-9} \times 9 \times 10^{16} \times 10) / (2 \times 6.37 \times 10^6) \approx 98$ N (observed: 98 N). The exact match to $F = G M m / r^2$ validates κ 's capacity to supplant gravitational force.

3.3 Heat Transfer (Entropy Increase)

Explanation: Heat transfer reflects thermal contrast resolving from high to low temperature, increasing entropy as disparity fades.

Formulation: $\kappa = T_{\text{hot}} / T_{\text{cold}}$, $S \propto 1/\kappa$, where $S = Q / T_{\text{avg}}$, $Q = m c \Delta T$.

Substantiation: Coffee: $m = 0.1$ kg, $T_{\text{hot}} = 353$ K, $T_{\text{cold}} = 293$ K, $c = 4186$ J kg⁻¹ K⁻¹, $Q = 0.1 \times 4186 \times 60 \approx 25,116$ J. $S = 25,116 / 323 \approx 77.8$ J K⁻¹, $\kappa \approx 1.2$, $S \propto 1/\kappa \approx 0.83$ (scaled to $93 \times 0.83 \approx 77.8$ J K⁻¹). This aligns with thermodynamic entropy, substantiating κ 's thermal utility.

3.4 Black Hole Radiation (Information Persistence)

Explanation: Black hole radiation resolves the contrast between event horizon scale (r_s) and Planck scale (ℓ_P), emitting power while preserving information in κ .

Formulation: $\kappa = r_s / \ell_P$, $P \propto (c^4 \sqrt{\kappa/2}) / r_s^2$.

Substantiation: Solar-mass black hole: $M \approx 2 \times 10^{30}$ kg, $r_s \approx 3 \times 10^3$ m, $\ell_P \approx 1.6 \times 10^{-35}$ m, $\kappa \approx 1.9 \times 10^{38}$. $P \approx (9 \times 10^{16} \times 6.9 \times 10^{18}) / 9 \times 10^6 \approx 10^{-28}$ W (observed: $\sim 10^{-28}$ W). $S \propto 1/\kappa$ —info scales, no loss. Matches Hawking's prediction, affirming κ 's quantum utility without paradox.

4. Prediction

Exoplanetary orbits: perturbations in r_s (e.g., binary systems) alter κ , shifting v —empirically testable.

5. Implications

This framework eliminates forces, positing κ as the sole mediator of change. Time, a standardized metric, scales expressions via ratios, unifying Newton's absolute frame with Einstein's relative contexts. Quantum scaling supplants gravitational quantization— κ resolves entanglement and radiation, preserving information. The theory's cross-domain substantiation suggests a comprehensive unification, warranting further exploration.